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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/634,964	08/05/2003	Zhendong Liu	02039US	6941

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07/06/2005

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EXAMINER

GEORGE, PATRICIA ANN

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 07/06/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/634,964

Applicant(s)

LIU, ZHENDONG

Examiner

Patricia A. George

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 8/5/03.
- 2a) ☐ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☐ Claim(s) 1-7 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 8-10 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 05 August 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 10-31-03; 3-21-05 & 2-4-05
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-7, are drawn to composition, classified in class 252, subclass 79.
- II. Claims 8-10, drawn to process of use, classified in class 438, subclass 692.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as product and process of use. The inventions can be shown to be distinct if either or both of the following can be shown: (1) the process for using the product as claimed can be practiced with another materially different product or (2) the product as claimed can be used in a materially different process of using that product (MPEP § 806.05(h)). In the instant case, the invention of group I could be used to polish a substrate other than that claimed in group II, such as silver.

Because these inventions are distinct for the reasons given above and the search required for Group I is not required for Group II, restriction for examination purposes as indicated is proper.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

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During a telephone conversation with Blake Biederman on May 17, 2005 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-7. Affirmation of this election must be made by applicant in replying to this Office action. Claims 8-10 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1 - 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sun et al (US Patent No. 6,709,316) in view of Yano (US Patent No. 6,375,545).

The reference of Sun et al discloses an aqueous chemical mechanical planarizing composition (col. 9, l. 14). The composition comprises an oxidizer in the

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form of promoting barrier removal since the composition is the same (col. 6, lines 57-59); an abrasive in the form of (col. 7, lines 9-12); an inhibitor in the form of (for decreasing removal of a metal interconnect) (col. 6, lines 59-65). In addition, the reference teaches chemical mechanical planarizing composition has a pH of less than or equal to 4 (col. 7, lines 53-59) and a tantalum nitride removal rate of at least eighty percent of copper removal rate (col.3, lines 32-34). Sun cites a 1:0:0 removal rate which indicates that 100% of the barrier layer (i.e. TaN) is removed relative to 0% of the copper and 0% of the dielectric.

In addition Sun teaches a pad pressure of 13.8 kPa. (col. 12, line 1) which is within Sun's range of 1 to 8 psi (6.895 kPa to 55.158 kPa). Sun broadly discloses the use of a chelating agent (col.6, lines 49-54), including the use of carboxyl acids (see claim 10).

Sun fails to disclose the use of polymers, made from carboxyl acids, as a feature of the chelating agent.

Yano teaches that such chelating agents are useful (US Patent No. 6,375,545 col. 9, lines 8-16) in CMP slurry (Col. 16, L. 8).

It would have been obvious to one ordinary skill in the art at the time of invention was made, to include a chelating agent with polymers in the CMP slurry of Sun because Yano teaches polymer blends in slurry are useful in they can be prepared to have ranges of conductivity to enhance the chelating effect of forming bonds with metals. As a result, particulates of the interconnect metals are carried away from the surface of the wafer maximizing removal rates while decreasing surface scratching.

As to claims 2 and 3, Sun broadly discloses the use of a chelating agent (col.6, lines 49-54), including the use of carboxyl acids (see claim 10).

Sun fails to disclose the use of polymers, made from carboxyl acids, as a feature of the chelating agent.

Yano teaches wherein the carboxylic acid polymer comprises a homopolymer or a copolymer (col. 3, lines 8-29) and wherein the carboxylic acid polymer comprises polymaleic acid (col. 7, lines 61-61, and col. 8, line 1). See complete discussion of Sun in view of Yano above.

It would have been obvious to one ordinary skill in the art at the time of invention was made, to modify Sun's CMP slurry by adding said chelating agents as Yano teaches they are useful (col. 3, lines 8-29) in CMP slurry.

As to claim 4, Sun teaches having a pH of 1.5 to 4 (col. 7, lines 53-59).

As to claim 5, Sun teaches an aqueous chemical mechanical planarizing composition comprising 0.05 to 15 wt % abrasive (col. 7, lines 9-12); 0.1 to 10 wt % oxidizing agent (col. 6, lines 57-59); and 0.02 to 1 wt% benzotriazole (col. 6, lines 59-65) which falls within the range of the instant invention. In addition, the references teach that the pH of the chemical mechanical planarizing composition is less than or equal to 4 (col. 7, lines 53-59) and a tantalum nitride removal rate of at least eighty percent of copper removal rate (col.3, lines32-34). Sun cites a

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1:0:0 removal rate which indicates that 100% of the barrier layer (i.e. TaN) is removed relative to 0% of the copper and 0% of the dielectric at a pad pressure of 13.8 kPa. (col. 12, line 1) with in Sun's range of 1 to 8 psi (6.895 kPa to 55.158 kPa). Sun's range is within the claimed range.

The reference of Sun fails to teach the wt % of a carboxylic acid polymer.

Yano teaches 0.01 to 5 wt % of a carboxylic acid polymer (col. 9, lines 20-22), wherein at least one repeat unit of the polymer has at least two carboxylic acid functionalities (col. 3, lines 8-29).

It would have been obvious to one ordinary skill in the art at the time of invention was made, to modify to modify the CMP slurry of Sun to include a chelating agent with polymers because polymer blends in slurry are useful in they can be prepared to have ranges of conductivity to enhance the chelating effect of forming bonds with metals. As a result, particulates of the interconnect metals are carried away from the surface of the wafer maximizing removal rates while decreasing surface scratching.

As to claims 6 and 7, see the references of claims 2 and 3.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

In International Publication No WO 01/17006, Uchida et al disclose a compound used for a CMP method, which comprises an oxidizer, abrasive, an inhibitor, water-

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soluble polymers, and controlled pad pressure. The composition and method of use are very similar to the instant invention.

In US Patent No. 6,858,540 Sun et al disclose a CMP method that results in the rapid removal of a Ta barrier layer comprising of an aqueous liquid, a reducing agent, at least one pH adjusting agent, an abrasive, a metal corrosive inhibitor, a chelating agent, water, and metal ions.

The "handbook of Multilevel Metallization for Integrated Circuits – Materials, Technology, and Applications" by William Andrew Publishing/Noyes note in 1993 that metal polishing is done with acidic aqueous slurries (i.e. oxidizers) to enhance the removal rates. It is also noted that abrasive make up, up to 30% of the wt % of the compound.

In US Patent No. 6,194,366, Naghshineh et al discloses a cleaning solution for copper containing microelectronic substrates. The use of acids from the "cabox" group is included. This composition is intended to be used as a post CMP polish step.

In US Patent No. 6,447,371 Kaufman et al discloses a CMP slurry comprised of an abrasive, and oxidizer, an inhibitor, and a pH-adjusting agent used to polish a substrate containing copper and tantalum or tantalum nitride. The only feature not disclosed by Kaufman is the chelating agent.

In US Patent No. 5,658,993, Denzinger et al discloses the method for preparation and use of water-soluble copolymers including a method for cleaning hard surfaces. Denzinger does not discuss specify the use of these chelating agents in a CMP slurry, but specifically cites use as water treatment agents used in systems conveying water.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patricia A. George whose telephone number is (571) 272-5955. The examiner can normally be reached on weekdays from 7:00am to 4:30pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


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NADINE G. NORTON
SUPERVISORY PATENT EXAMINER

